

5427 24. (Amended) A method of extrusion processing a mixture of thermoplastic materials, said process comprising:

A² introducing at least two thermoplastic polymers into an extruder barrel, the at least two thermoplastic polymers comprising a first thermoplastic polymer and a second thermoplastic polymer, and wherein the first thermoplastic polymer has a higher percent crystallinity than the second thermoplastic polymer;

heating the mixture of thermoplastic materials to provide a molten blend thereof; contacting the molten blend of thermoplastic materials with a blowing agent; and subjecting the blend to conditions sufficient to create a thermodynamic instability in the blend to foam the blend, wherein the foamed blend has a percent crystallinity lower than the first thermoplastic polymer;

wherein the foamed material formed by said method has a plurality of distinct void spaces formed therein.

Please cancel Claims 16, 22, 39, 45 and 47-64 without prejudice or disclaimer thereto.

Please enter the following new claims.

65. (New) The method according to Claim 1, wherein the blowing agent is selected from the group consisting of inorganic agents, organic blowing agents, and chemical blowing agents.

66. (New) The method according to Claim 65, wherein the blowing agent is an inorganic blowing agent selected from the group consisting of carbon dioxide, nitrogen, argon, water, air nitrogen, and helium.

67. (New) The method according to Claim 65, wherein the blowing agent is

an organic blowing agent selected from the group consisting of aliphatic hydrocarbons having 1-9 carbon atoms, aliphatic alcohols having 1-3 carbon atoms, and fully and partially halogenated aliphatic hydrocarbons having 1-4 carbon atoms.

68. (New) The method according to Claim 65, wherein the blowing agent is a chemical blowing agent selected from the group consisting of azodicarbonamide, azodiisobutyronitrile, benzenesulfonhydrazide, 4,4-oxybenzene sulfonylsemicarbazide, p-toluene sulfonyl semicarbazide, barium azodicarboxylate, N,N'-dimethyl-N,N'-dinitrosoterephthalamide, and trihydrazino triazine.

69. (New) The method according to Claim 24, wherein the blowing agent is selected from the group consisting of inorganic agents, organic blowing agents, and chemical blowing agents.

70. (New) The method according to Claim 69, wherein the blowing agent is an inorganic blowing agent selected from the group consisting of carbon dioxide, nitrogen, argon, water, air nitrogen, and helium.

71. (New) The method according to Claim 69, wherein the blowing agent is an organic blowing agent selected from the group consisting of aliphatic hydrocarbons having 1-9 carbon atoms, aliphatic alcohols having 1-3 carbon atoms, and fully and partially halogenated aliphatic hydrocarbons having 1-4 carbon atoms.

72. (New) The method according to Claim 69, wherein the blowing agent is a

chemical blowing agent selected from the group consisting of azodicarbonamide, azodiisobutyronitrile, benzenesulfonhydrazide, 4,4-oxybenzene sulfonylsemicarbazide, p-toluene sulfonyl semicarbazide, barium azodicarboxylate, N,N'-dimethyl-N,N'-dinitrosoterephthalamide, and trihydrazino triazine.

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73. (New) A method of producing a foamed material, said method comprising:
contacting a mixture comprising a first thermoplastic polymer and a second thermoplastic polymer with a blowing agent comprising a surfactant, wherein the surfactant is a copolymer selected from the group consisting of a graft copolymer, a block copolymer, and a random copolymer, wherein the first thermoplastic polymer has a higher percent crystallinity than the second thermoplastic polymer; and

subjecting the mixture to conditions sufficient to create a thermodynamic instability in the mixture to foam the mixture, the mixture comprising the first and second thermoplastic polymers having a percent crystallinity lower than the first thermoplastic polymer.

74. (New) The method according to Claim 73, wherein the blowing agent is carbon dioxide.

75. (New) The method according to Claim 74, wherein the carbon dioxide is liquid carbon dioxide.

76. (New) The method according to Claim 74, wherein the carbon dioxide is supercritical carbon dioxide.

77. (New) The method according to Claim 74, wherein at least one of the first and second thermoplastic materials is amorphous.

78. (New) The method according to Claim 77, wherein the mixture of thermoplastic materials is amorphous.

79. (New) The method according to Claim 74, wherein at least one of the first and second thermoplastic materials is semicrystalline.

80. (New) The method according to Claim 74, wherein the first thermoplastic polymer is semicrystalline and the second thermoplastic material is amorphous.

81. (New) The method according to Claim 80, wherein the mixture of thermoplastic materials is amorphous.

82. (New) The method according to Claim 74, wherein the first and second thermoplastic polymers are each independently selected from the group consisting of PVDF, sPS, PTFE, PVC, Nylon (6,6), polyvinylmethylether, PP, PE, HDPE, PS, PMMA, polyisobutylene, PVA, PDMS, PEO, poly(phenylene oxide), PVF, PVDC, PVC, PVOH, PVAc, PC, ethyl acetate, PET, poly(ethylene naphthalate), poly(ϵ -caprolactone), poly(ether imide), chemical derivatives thereof, and mixtures thereof.

83. (New) The method according to Claim 74, wherein the first thermoplastic polymer is selected from the group consisting of PVDF, sPS, PTFE, PVC, Nylon (6,6), polyvinylmethylether, PP, PE, HDPE, PVF, PVDC, PVOH, PVAc, PC, ethyl acetate, PET, poly(ethylene naphthalate), poly(ϵ -caprolactone), poly(ether imide), chemical derivatives thereof, and mixtures thereof; and the second thermoplastic polymer is selected from the group consisting of PS, PMMA, polyisobutylene, PVA, PDMS, PEO, poly(phenylene oxide), PC, chemical derivatives thereof, and mixtures thereof.

84. (New) The method according to Claim 74, wherein the first thermoplastic polymer is PVDF and the second thermoplastic polymer is PMMA.

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85. (New) The method according to Claim 74, wherein said subjecting step comprises separating the mixture from the blowing agent to foam the mixture.

86. (New) The method according to Claim 85, wherein said step of separating the mixture comprises venting the blowing agent.

87. (New) The method according to Claim 74, wherein the blowing agent further includes a co-solvent.

88. (New) The method according to Claim 74, wherein the blowing agent is carbon dioxide and the surfactant comprises a CO₂-philic segment.

89. (New) The method according to Claim 88, wherein the CO₂-philic segment comprises a fluoropolymer.

90. (New) The method according to Claim 88, wherein the CO₂-philic segment comprises a fluoropolymer formed from at least one monomer selected from the group consisting of fluoroacrylate monomers, fluoroolefin monomers, fluorostyrene monomers, fluoroalkylene oxide monomers, fluorinated vinyl alkyl ether monomers, and mixtures thereof.

91. (New) The method according to Claim 74, wherein the surfactant comprises a CO₂-phobic segment.

92. (New) The method according to Claim 91, wherein the CO₂-phobic segment is a polymer formed from at least one monomer selected from the group consisting of styrenics, α -olefins, ethylene oxides, dienes, amides, esters, sulfones, sulfonamides, imides, thiols, alcohols, diols, acids, ethers, ketones, cyanos, amines, quaternary ammonium salts, acrylates, methacrylates, thiozoles, and mixtures thereof.

93. (New) The method according to Claim 74, wherein the blowing agent further includes a modifier selected from the group consisting of a reactant modifier, water, a plasticizing agent, an anti-bacterial agent, a toughening agent, a processing aid, a colorant, a dye, a flame retardant, and mixtures thereof.

94. (New) The method according to Claim 24, wherein the blowing agent is selected from the group consisting of inorganic agents, organic blowing agents, and chemical blowing agents.

95. (New) The method according to Claim 94, wherein the blowing agent is an inorganic blowing agent selected from the group consisting of carbon dioxide, nitrogen, argon, water, air nitrogen, and helium.

96. (New) The method according to Claim 94, wherein the blowing agent is an organic blowing agent selected from the group consisting of aliphatic hydrocarbons having 1-9 carbon atoms, aliphatic alcohols having 1-3 carbon atoms, and fully and partially halogenated aliphatic hydrocarbons having 1-4 carbon atoms.

97. (New) The method according to Claim 94, wherein the blowing agent is a chemical blowing agent selected from the group consisting of azodicarbonamide, azodiisobutyronitrile, benzenesulfonhydrazide, 4,4-oxybenzene sulfonylsemicarbazide, p-

toluene sulfonyl semicarbazide, barium azodicarboxylate, N,N'-dimethyl-N,N'-dinitrosoterephthalamide, and trihydrazino triazine.

Sub 98. (New) A method of extrusion processing a mixture of thermoplastic materials, said process comprising:

introducing at least two thermoplastic polymers into an extruder barrel, the at least two thermoplastic polymers comprising a first thermoplastic polymer and a second thermoplastic polymer, and wherein the first thermoplastic polymer has a higher percent crystallinity than the second thermoplastic polymer;

heating the mixture of thermoplastic materials to provide a molten blend thereof;

contacting the molten blend of thermoplastic materials with a blowing agent comprising at least one surfactant, wherein the surfactant is a copolymer selected from the group consisting of a graft copolymer; and

subjecting the blend to conditions sufficient to create a thermodynamic instability in the blend to foam the blend, wherein the foamed blend has a percent crystallinity lower than the first thermoplastic polymer.

99. (New) The method according to Claim 98, wherein said step of contacting the molten blend of thermoplastic materials occurs in a mixing section of the extruder.

100. (New) The method according to Claim 98, wherein said subjecting step comprises separating the blowing agent from the molten blend of thermoplastic polymers to form a foamed thermoplastic mixture.

101. (New) The method according to Claim 100, wherein said step of separating the blowing agent from the blend comprises venting the blowing agent.

102. (New) The method according to Claim 98, wherein the blowing agent is carbon dioxide.

103. (New) The method according to Claim 102, wherein the carbon dioxide is liquid carbon dioxide.

104. (New) The method according to Claim 102, wherein the carbon dioxide is supercritical carbon dioxide.

105. (New) The method according to Claim 98, wherein at least one of the first and second thermoplastic materials is amorphous.

106. (New) The method according to Claim 105, wherein the blend of thermoplastic materials is amorphous.

107. (New) The method according to Claim 106, wherein at least one of the first and second thermoplastic materials is semicrystalline.

108. (New) The method according to Claim 105, wherein the first thermoplastic polymer is semicrystalline and the second thermoplastic material is amorphous.

109. (New) The method according to Claim 98, wherein the first thermoplastic polymer and the second thermoplastic polymer are each independently selected from the group consisting of PVDF, sPS, PTFE, PVC, Nylon (6,6), polyvinylmethylether, PP, PE, HDPE, PS, PMMA, polyisobutylene, PVA, PDMS, PEO, poly(phenylene oxide), PVF, PVDC, PVOH, PVAc, PC, poly(ethyl acetate), PET, poly(ethylene naphthalate), poly(ϵ -caprolactone), poly(ether imide), chemical derivatives thereof, and mixtures thereof.

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110. (New) The method according to Claim 98, wherein the first thermoplastic polymer is selected from the group consisting of PVDF, sPS, PTFE, PVC, Nylon (6,6), polyvinylmethylether, PP, PE, HDPE, PVF, PVDC, PVOH, PVAc, PC, poly(ethyl acetate), PET, poly(ethylene naphthalate), poly(ϵ -caprolactone), poly(ether imide), chemical derivatives thereof, and mixtures thereof; and the second thermoplastic polymer is selected from the group consisting of PS, PMMA, polyisobutylene, PVA, PDMS, PEO, poly(phenylene oxide), PC, chemical derivatives thereof, and mixtures thereof.

111. (New) The method according to Claim 98, wherein the first thermoplastic polymer is PVDF and the second thermoplastic polymer is PMMA.

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112. (New) The method according to Claim 98, wherein the blowing agent further includes a co-solvent.

113. (New) The method according to Claim 98, wherein the surfactant comprises a CO₂-philic segment.

114. (New) The method according to Claim 113, wherein the CO₂-philic segment comprises a fluoropolymer

115. (New) The method according to Claim 113, wherein the CO₂-philic segment comprises a fluoropolymer formed from at least one monomer selected from the group consisting of fluoroacrylate monomers, fluoroolefin monomers, fluorostyrene monomers, fluoroalkylene oxide monomers, fluorinated vinyl alkyl ether monomers, and mixtures thereof.

116. (New) The method according to Claim 98, wherein the surfactant comprises a CO₂-phobic segment.

117. (New) The method according to Claim 116, wherein the CO₂-phobic segment is a polymer formed from at least one monomer selected from the group consisting of styrenics, α -olefins, ethylene oxides, dienes, amides, esters, sulfones, sulfonamides, imides, thiols, alcohols, diols, acids, ethers, ketones, cyanos, amines, quaternary ammonium salts, acrylates, methacrylates, thiozoles, and mixtures thereof.

118. (New) The method according to Claim 98, wherein the blowing agent further includes a modifier selected from the group consisting of a reactant modifier, water, a plasticizing agent, an anti-bacterial agent, a toughening agent, a processing aid, a colorant, a dye, a flame retardant, and mixtures thereof.

119. (New) The method according to Claim 98, wherein the blowing agent is selected from the group consisting of inorganic agents, organic blowing agents, and chemical blowing agents.

120. (New) The method according to Claim 119, wherein the blowing agent is an inorganic blowing agent selected from the group consisting of carbon dioxide, nitrogen, argon, water, air nitrogen, and helium.

121. (New) The method according to Claim 119, wherein the blowing agent is an organic blowing agent selected from the group consisting of aliphatic hydrocarbons having 1-9 carbon atoms, aliphatic alcohols having 1-3 carbon atoms, and fully and partially halogenated aliphatic hydrocarbons having 1-4 carbon atoms.